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LARVAE OF NEOTROPICAL COLEOPTERA. VI. SCARABAEIDAE, DYNASTINAE, PHILEURINI

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ABSTRACT

The third instar larva and the pupa of Homophileurus luederwaldti *(Ohaus, 1910) and* Trioplus cylindricus *(Mannerheim, 1829), collected in southern Brazil and reared in laboratory, are described and illustrated. A short description of the larva of* Actinobolus trilobus *Luederwaldt, 1910, is also included. A set of larval characteristics for the Phileurini is provisionally provided.*

Immatures of T. cylindricus *are found in decayed logs. Immatures of* A. trilobus *feed on* Nasutitermes *carton nests (Luederwaldt, 1911). Immatures and adults of* H. luederwaldti *are found inside carton nests of* Microcerotermes *sp. n. and* Nasutitermes *sp. n.; larval feeding may hollow the center of the nest and even result in the nest destruction; pupation occurs inside nest walls; the nest seems to constitute the main feeding source and an adequate place for the development of the beetle.*

INTRODUCTION

The tribe Phileurini of the Dynastinae contains 21 genera in the Neotropics, 14 of them represented in Brazil (Endrodi, 1977, 1978).

The biology of our native species of Phileurini is poorly known, and there are only few accounts on this subject (*v. g.* Ohaus, 1900, and 1909; Luederwaldt, 1911). Larvae and adults are xylophagous, being found in decayed wood, and a few species are reported as termitophilous (Luederwaldt, 1911), feeding on termite nests.

The immature stages of endemic Neotropical Phileurini have not been described yet. Only the larva of *Phileurus dydimus* (Linn.), a widely distributed species which occurs in Mexico, Central America, West Indies and South America (Endrodi, 1978) has been described by Ritcher (1966).

We had the opportunity of rearing two species: *Trioplus cylindricus* (Mannherheim, 1829) and *Homophileurus luederwaldti* (Ohaus, 1910). This paper

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deals with the descriptions of, and bionomic notes on, larvae and pupae of both species. By checking the material of Phileurini housed in the Museu de Zoologia, Universidade de São Paulo, we have found dried larvae of *Actinobolus trilobus* Luederwaldt, 1910, collected and determined by Luederwaldt himself. We decided to include a short description of this species, although incomplete, to allow a comparison among the three genera.

Notes on the biology of Brazilian phileurids

Termitophily in the Phileurini has been recorded only by Luederwaldt (1911). In his interesting paper the author described observations on the biology of *Homophileurus luederwaldti* and *Actinobolus trilobus*, both living inside arboreal nests of two species of *Nasutitermes* (named as *Eutermes* spp. by Luederwaldt, *l.c.*: 405), and of *Actinobolus radians*, which lives inside epigeous nests of *Cornitermes* sp. n., in the vicinities of the city of São Paulo. He noted that the larvae of the three scarabs feed directly upon the nest, and as they may occur in large number (the largest amount was 18 *A. trilobus*, 28 *A. radians* and 15 *H. luederwaldti*, each species inhabiting a single nest) the destructive effect of their feeding activity result in partial or even total destruction of the termite colony.

While collecting termites and coleopterous larvae in the forest (6-12 m in heigth) which cover the sandy ("restinga") soil of Itanhaém, in the littoral of the state of São Paulo, we found that two species of termites, *Microcerotermes* sp. n. and *Nasutitermes* sp. n., were very common and frequently built conspicuous carton nests attached to trunks or branches of usually living trees (tig. 25), from 1 to 6 meters above the ground. The nests of both genera were brown to dark brown, globular to more or less elongate, and from 35 cm to about 1 m in length. The royal cells were in the middle of the nest, near the trunk or branch to which the nest is attached, and was surrounded by cells with very thick walls; the remaining cells had thin walls, which were thinner in the cells near the surface of the nest.

In middle summer of 1978, one adult, 2 pupae and 11 last instar larvae of *H. luederwaldti* were obtained from a nest of *Microcerotermes* sp.n., in that area of Itanhaém. The nest measured 35 cm in height and 38 × 90 cm in width and showed at the upper surface a circular opening about 2 cm in diameter, leading to a straight canal towards the center of the nest. After being broken, the nest revealed an impressive central hollow 14 cm high and 15 × 37 cm wide (fig. 26), in which the larvae and the adult rested completely immobile if not touched. The floor of the hollow was covered by a layer a few centimeters thick of nest powder, fecal pellets, and hundreds of larvae of small alleculid (mature larvae 10 to 12 mm long). From the walls of the hollow, small holes led to pupal chambers immersed in the nest structure. Figure 64 is a scheme of the nest described above. The immatures collected in the nest described above were taken into plastic or glass containers and reared in plastic dishes with a nest segment free of termites. Prior to pupation the larva dug a pupal chamber in the nest wall, but did not make a coocon of wall particles, as seen by Luederwaldt (*l.c.*: 409) for *Actinobolus*. Pupal phase (fig. 27) lasted 21 to 24 days. Fecal pellets of the third instar larvae (fig. 28) were black, opaque, parallelepiped-shaped, 6 to 7 mm long, 4 to 5 mm wide and 2 mm high; the narrower extremity was rounded while the opposite one was irregularly notched. Some of the pellets showed irregular excavations, produced by the alleculid larvae which apparently feed on the pellets and profit by the remains of organic debris that are laied up on the floor of the hollow.

Some interesting considerations may be draw from the fact that *H. luederwaldti* inhabits living termite nests. First, the wooden material which constitutes

the nest (partially digested by termite workers) provides the energy required for the development of the larvae. Secondly, both adult and immature stages of the beetle must in someway be adapted to avoid attack of termite soldiers, either from physical (the long and sharp pointed mandibles of *Microcerotermes* soldiers) or chemical means (the fluid ejected through the frontal nose of the head of the nasute soldier of *Nasutitermes*). The termites seem to be able to approach only dead scarabs, whose bodies are coated with nest material, and are unable to prevent their own colony from being eaten and destroyed by the beetle. Finally, it is worth noting that after 3 years of periodic collecting in the region, no immature, adult or fecal pellet aglomerations of *H. luederwaldti* were found except inside termite nests. The inside of the nest is a closed environment, protected from most climatic variations and enemies from the outside, so that (at least in the forest concerned) termite nests seem to constitute the main (and perhaps the only) feeding source and place for the development of the beetle.

Little was known about the biology of species of *Trioplus*, except for the fact that larvae and adults may be found together in decaying logs (Ohaus, 1900). In middle summer of 1979 we collected six third instar larvae of *T. cylindricus* in a rotten log on the ground in São Paulo. The larvae were kept in a large glass container, half filled with pieces of wood, until close to pupation, when they were transferred to individual Petri dishes with wood. One larva built a pupal chamber of fragments of wood, while the other two dug oval-shaped pupal chambers in pieces of wood (these cells were 24-28 mm in length, and 10-12 mm in width). Pupal phase lasts 17 to 18 days. The adults were 18-19 mm long.

Homophileurus luederwaldti (Ohaus, 1910)

Description of third instar larva (figs. 1-21)

Larva C-shaped. Body length: 52 to 66 mm.

Head (fig. 1). Maximum width of head capsule: 6.7 to 7.3 mm; dorsum and sides slightly roughened, frons punctate in the anterior two-thirds, most punctures bearing a minute setae; yellow-brown, with precoila black; preclypeus whitish. Epicranial stem 1:4.4 as long as head. Dorso-epicranial setae 1 to 3 large and 5 to 6 short on each side laterad of epicranial suture. Setae numerous behind the antennal support. Frons: primary setae difficult to distinguish because of the large number of setae present; frontal setae 8 to 10; exterior frontal setae 2; posterior frontal setae 4; anterior angle setae consisting of 1 large and 3 small setae on each side. *Ocelli* present. *Clypeus* trapezoidal, bearing two large external clypeal setae on each side; anterior clypeal setae absent. Labrum subtrapezoidal, 1.1. times longer than clypeus, bearing numerous setae; surface roughened. *Epipharynx* (fig. 15) with lateral margins rounded. Haptomeral region with zygum ridge-like; epizygum present; heli absent; proplegmata and plegmata absent; chaetoparia with medially directed setae, few or no sensilla interspersed among the setae; laetotorma with pternotormal process well sclerotized; aptormal process absent; dexiotorma curved in the basal third and straight in the apical two-thirds; both nesia present: chitinous plate and sense cone. *Mandibles*: Left mandible (figs. 7-9) — scissorial area with 3 teeth; molar area with 2 lobes, proximal lobe with 2 depressions; with a short acute acia, almost as long as wide; brustia present. Right mandible (figs. 4-6) — scissorial area with 3 teeth; molar area with 2 lobes. Stridulatory area of each mandible well-marked, with ridges of similar width. *Maxilla* (fig. 16) with fused galea and lacinia forming mala; galea with a single, apical uncus, 0,4 times as long as the last segment of maxillary palp;

lacinia with 3 unci, the 2 distal larger and fused at their bases (fig. 16b); maxillary stridulatory area (fig. 16a) formed by 6 to 7 little subtrapezoidal, truncate teeth, and a wide, truncate anterior process. *Labium* (figs. 2-3): hypopharynx with right anterior process of hypopharyngeal sclerome almost as long as the basal segment of the labial palp, heavely sclerotized; left hypopharyngeal lobe with about 11 lateral setae. *Antenna* 4-segmented; third segment extended into an obtuse process at distal end; dorsal surface of last antennal segment with 4 to 6 sensory spots (figs. 10-12).

Thorax. *Prothorax*: with a single dorsal lobe, on each side with a small sclerotized lateral area, diamond-shaped, 3,5 times higher than the spiracular height; yellowish, with a posterior dorso-ventral row of 2 to 3 large and 5 to 9 short setae. *Mesothorax*: mesoprescutum and mesoscutellum with a transverse row of 6 long setae; mesoscutum without long setae, only about 10 short setae present. *Metathorax*: metaprescutum and metascutellum with a transverse row of 6 long setae; metascutum without long setae, only about 15 short setae present. *Thoracic spiracle* (fig. 13): 0.80 to 0.85 mm long and 0.53 to 0.54 mm wide; respiratory plate with irregular-shaped holes (fig. 14), not arranged in definite transverse rows; lobes of respiratory plate slightly separated. *Claws* (figs. 17-19): falcate, each claw with 2 prominent setae; claws of metathoracic legs much smaller.

Abdomen. Segment 1 with 2 dorsal annulets; segments 2 to 6 with 3 dorsal annulets; each annulet with a transvere row of long, slender setae, and 1 to 4 rows of short, spine-like setae; short setae absent only on the first annulet of segment 1. Dorsa of segments 7 to 9 not divided into annulets (fig. 21); each dorsum with an anterior row of long and spine-like setae, and a posterior row of long setae with a very few spine- like short setae intermixed among the long ones. Dorsal impressed line present on segment 10. Pleural lobes with 14 to 21 long setae; spiracular area with 7 to 10 long setae. *Spiracles*: 8, ranging from 0.75 to 0.92 in length and 0.54 to 0.61 mm in width. *Raster* (fig. 20): without palidia; teges with 46 to 54 scattered, posteriorly directed setae, which covers the caudal half of the area between the lower anal lip and the caudal margin of abdominal segment 9. Lower anal lip covered with short setae, similar as on teges, and with a caudal fringe of 20 to 28 long, slender setae.

Description of pupa (figs. 22-24)

Length 35 mm. *Shape* elongate-ovate, exarate (fig. 22). *Color* (mature pupa) yellowish-brow; pronotum, elytra and gintraps darkened, spiracular rings black. Completely glabrous, smooth. *Head* (fig. 23) with 3 rounded tubercles, the anterior slightly wider than the 2 posterior ones; frons with a number of shallow depressions. *Pronotum* subtrapezoidal, nearly twice as wide as long. *Scutellum* trapezoidal, 1.1 times as wide as long. *Pterothecae* closely apressed to body, curved ventrally around the body, extending posteriorly to third abdominal segment. *Abdomen* with 4 pairs of spiracles, the first pair concealed by the pterothecae. Six pairs of gin-traps present in the mid-dorsal edge of segments 2/3, 3/4, 4/5, 5/6, 6/7 and 7/8. Last abdominal segment with an apical notch (fig. 24).

Material examined. Brazil. *São Paulo*: Itanhaém, 12.I.1978, L. R. Fontes coll., in the nest of *Microcerotermes* sp. (sample number 7549, MZSP), 7 sets of larval and pupal skins associated with reared adults, 4 last instar larvae, 2 pupae and 1 adult; same locality, 16.VI.1979, L. R. Fontes coll., 3 last instar larvae found dead inside a fallen nest of *Microcerotermes* sp.

DISCUSSION

The genus *Homophileurus* includes 9 Neotropical species, 4 of which occurring in Brazil (Endrodi, 1978).

Ritcher (1944) provides short descriptions for the larvae of the North American species *Phileurus castaneus* Haldeman, 1843 (synonym of *P. valgus* Olivier, 1789) and *Phileurus illatus* Le Conte, 1854 (now placed in the genus *Hemiphileurus*). The same author (1966) describes the larva of a third species *Phileurus dydimus* (Linneu, 1758), a widely distributed species which occurs in the Nearctic and Neotropical regions.

The larva of *Homophileurus luederwaldti* is very similar to those of the above cited species, but well characterized by different arrangement of setae in the head capsule, and by the number of dorsal sensory spots in the last antennal segment. However, this second character does not seem to be trustworthy to separate the species, since we observed a great intraspecific variation in the 3 Neotropical phileurids examined (figs. 10-12, 53-54).

A fact must be considered when analyzing the mandibular dentition. The walls of the termite nest have grains of sand in its composition; the grains act as an abrasive, so that the mandibular teeth were worn out in most observed third instar larvae, particularly the pre-molar tooth, which may be obsolete or even undiscernible.

Actinobolus trilobus Luederwaldt, 1910

Description of third instar larva (figs. 29-42)

Larva C-shaped.

Head (fig. 29). Maximum width of head capsule 4,9 to 5,1 mm; surface of cranium pitted laterad to the epicranial stem and to the frontal sutures; frons slightly rugose, especially on the anterior part; epicranial stem 1:4.9 as long as head, with a rather dense covering of setae, very variable on the material examined, making it difficult to distinguish primary setae. *Ocelli* present. *Epipharynx* (fig. 41): haptomeral region with a bilobed zygum; epizygum present; heli absent; chaetoparia well developed, sensilla absent; laetotorma with pternotormal process well sclerotized; aptormal process absent; dexiotorma sinuous; both nesia present, chitinous plate and sense cone. *Mandibles*: Left mandible (figs. 33-35) — scissorial area with 3 teeth well developed; molar area with 2 lobes, proximal lobe entire, smooth; acia slightly curved, acute; brustia present. Right mandible (figs. 30-32) — scissorial area with 3 teeth well developed; molar area with 2 lobes. Stridulatory area of each mandible with transverse ridges similar in width. *Maxilla* (fig. 42): with fused galea and lacinia forming mala; galea with a blunt uncus, about 0.5 times as long as last segment of maxillary palp; lacinia with 3 unci, the 2 distal fused at their base (fig. 42b); maxillary stridulatory area (fig. 42) with a row of 5 to 7 truncate teeth and a wide, anterior truncate process. *Labium* (figs. 33-40): hypopharynx with right anterior lateral process of hypopharyngeal sclerome poorly developed, scarcely visible in lateral view; hypopharyngeal lobe with a row of about 20 posterior lateral setae medially oriented. Antenna 4-segmented, third segment extended into an obtuse process at distal end; dorsal surface of last antennal segment with 3 to 4 sensory spots.

Thorax. *Claws* (figs. 36-38) falcate, each claw with 2 prominent setae; claws of prothoracic legs larger than the similar claws of meso- and metathoracic legs.

Material examined. Brazil. *São Paulo*: (Ipiranga), 12.XII.1907, Luederwaldt coll., in the nest of *Nasutitermes* sp., 5 head capsules, one set of legs, 2 sets of mandibles, 4 eggs mounted on pinned cardboards, Luerderwaldt det.

DISCUSSION

We are not presenting a more complete description because of the lack of material. Our study is based on old material, collected by Luederwaldt, represented only by dried head capsules and legs of the larvae, glued on pinned cardboards.

A. trilobus and *H. luederwaldti* can be found in the same termite nest so that it seems useful to point out some differences to recognize promptly the larvae of the two species.

a) In *A. trilobus* the head is wider, the setae are longer and more numerous, the punctures are coarser and deeper than in *H. luederwaldti.*

b) Epipharynx with a bilobed zygum in *A. trilobus,* sinuous but unnotched in *H. luederwaldti.*

c) Process of hypopharyngeal sclerome scarcely developed in *A. trilobus,* but in *H. luederwaldti* is almost as long as the basal segment of labial palp.

d) Tarsal claws very different, longer and more acute in H.*luederwaldti.*

Trioplus cylindricus (Mannerheim, 1829)

Description of third instar larva (figs. 43-61)

Larva C-shaped. Color cream-white (when alive). Body length 53 to 55 mm..

Head (fig. 43). Maximum width of head capsule 4.8 to 4.9 mm; dorsum and sides fairly smooth; frons punctate in the anterior two-thirds, the punctures being deeper, coarser, and coalescent near the anterior sides; yellow-brown, with precoila black. Epicranial stem 1:5.0 as long as head. Dorso-epicranial setae: 1 large and 1 short seta on each side. Frons: anterior frontal setae and exterior frontal setae absent; a single posterior frontal setae on each side; anterior angle setae with 1 large and 3 smaller setae on each side. *Ocelli* present. *Clypeus t*rapezoidal, with 3 external clypeal setae and 1 anterior clypeal setae on each side. Labrum subtrapezoidal, 1.25 times longer than clypeus, bearing 3 external and 2 discal setae on each side; surface coarsely roughened. *Epipharynx* (fig. 58) with lateral margins rounded; haptomeral region with zygum in the form of a raised ridge; epizygum present; heli absent; chaetoparia well developed, without sensilla interspersed among the medially directed setae; laetotorma with pternotormal process well sclerotized; aptormal process absent; dexiotorma curved; both nesia present, chitinous plate and sense cone. *Mandibles*: Left mandible (figs. 47-49) — scissorial area with 3 teeth; molar area with 2 lobes, proximal lobe entire, smooth; with a long, almost twice as long as wide, acute acia; brustia present. Rigth mandible (figs. 44-46) — scissorial area with 2 teeth; molar area with 2 lobes. Stridulatory area of each mandible well marked by thin striae of similar width. *Maxilla* (fig. 57) with fused galea and lacinia forming mala; galea with a well developed uncus, about 0.75 times as long as last segment of maxillary palp; lacinia with 3 unci, the 2 distal fused at their bases (fig. 57b); maxillary stridulatory area (fig. 57a) formed by 7 to 8 little sharp-pointed teeth and a wide, truncate anterior process; 1 or 2 teeth proximad to the anterior process may be rounded. *Labium* (figs. 55-56): hypopharynx with right anterior lateral process of hypopharyngeal sclerome strongly developed, approximately as long as the lenght of both segments of labial palp combined; heavely sclerotized; left hypopharyngeal lobe with a row of 11 to 13 posterior lateral setae, medially oriented. *Antenna* 4-segmented, third segment extended into an obtuse process at distal end; dorsal surface of last antennal segment (figs. 53-54) with 2 to 3 sensory spots.

Thorax. *Prothorax* with a single dorsal lobe, with narrow lateral areas, weakly sclerotized, 3.0 times higher than the spiracular height; light yellow, with a posterior dorso ventral row of 1 large and 1 or 2 short setae. *Mesothorax*: mesoprescutum with a transverse row of 4 long and 6 short setae; mesoscutum with only short setae, long setae absent; mesoscutellum bare. *Metathorax*: metaprescutum with a transverse row of 8 long setae; metascutum with 8 long setae; metascutellum with 2 short setae. *Thoracic spiracle* (fig. 60): 0.58 to 0.63 mm long and 0.35 to 0.37 mm wide; respiratory plate with indefinite number of irregular, poligonal shaped holes (fig. 61); lobes of respiratory plate well separated. *Claws* (figs. 50-52) falcate, of similar size, each claw with 2 prominent setae.

Abdomen. Segment 1 with 2 dorsal annulets; segments 2 to 6 with 3 dorsal annulets; each annulet with a transverse row of long, slender setae, and 1 to 4 rows of short spine-like setae; dorsa of segments 7 to 9 not divided into annulets; each dorsum with an anterior and a posterior row of long setae and scattered spine-like setae. *Spiracles*: 8, ranging from 0.53 to 0.63 mm in lenght and 0.40 to 0.49 mm in width. *Raster* (fig. 59) without palidia; teges with 18 to 21 scattered, posteriorly directed setae; lower anal lip covered with 22 to 25 short setae, similar as on teges, and with a caudal fringe of 16 or 17 long, slender setae.

Description of pupa (figs. 62-63)

Length 22.5 mm. *Shape* elongate-ovate, exarate. *Color* cream-white, gin-traps and spiracular rings dark-brown. Completely glabrous and smooth. *Head* with a pair of obtuse, conical tubercles, V-shaped; frons with 2 pairs of weakly developed swellings. *Pronotum* transverse, about 1.6 times as wide as long. *Pterothecae* closely apressed to body, curved ventrally around the body, extending posteriorly to third abdominal segment. *Abdomen* with 4 pairs of spiracles, the first pair concealed by the pterothecae. Six pairs of gin traps present in the mid-dorsal edge of segments 2/3, 3/4, 4/5, 5/6, 6/7 and 7/8; the first pair of gin-traps the best and the last the less developed. Last abdominal segment with and apical notch.

Material examined. Brazil. *São Paulo:* São Paulo (Cidade Universitária), 9.I.1979, S. A. Vanin and C. Costa coll., from decayed log. 2 last instar larvae, 3 sets of larval and pupal skins associated with reared adults, 1 last instar larvae reared to pupae.

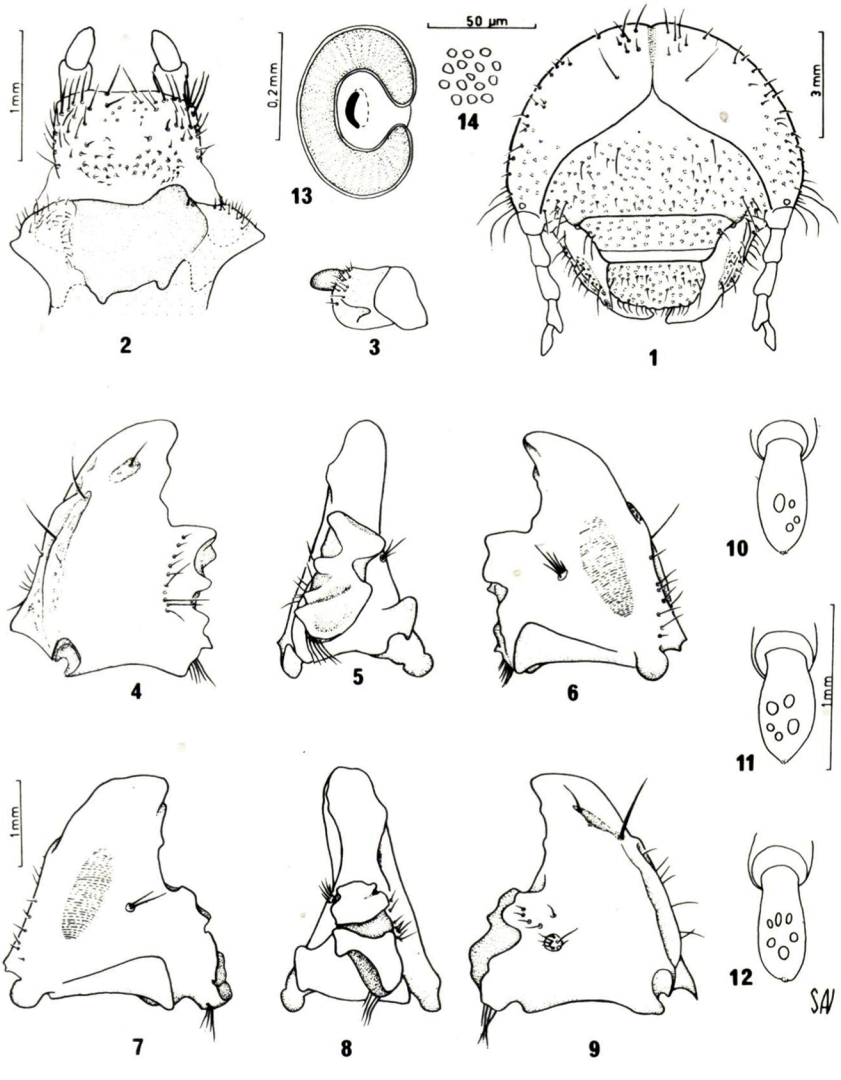
CONCLUSION

Due to the scarcity of descriptions it seems premature to provide diagnostic characters for the larval stages of Phileurini. We present therefore the following set of characteristics, which may be of tribal value:

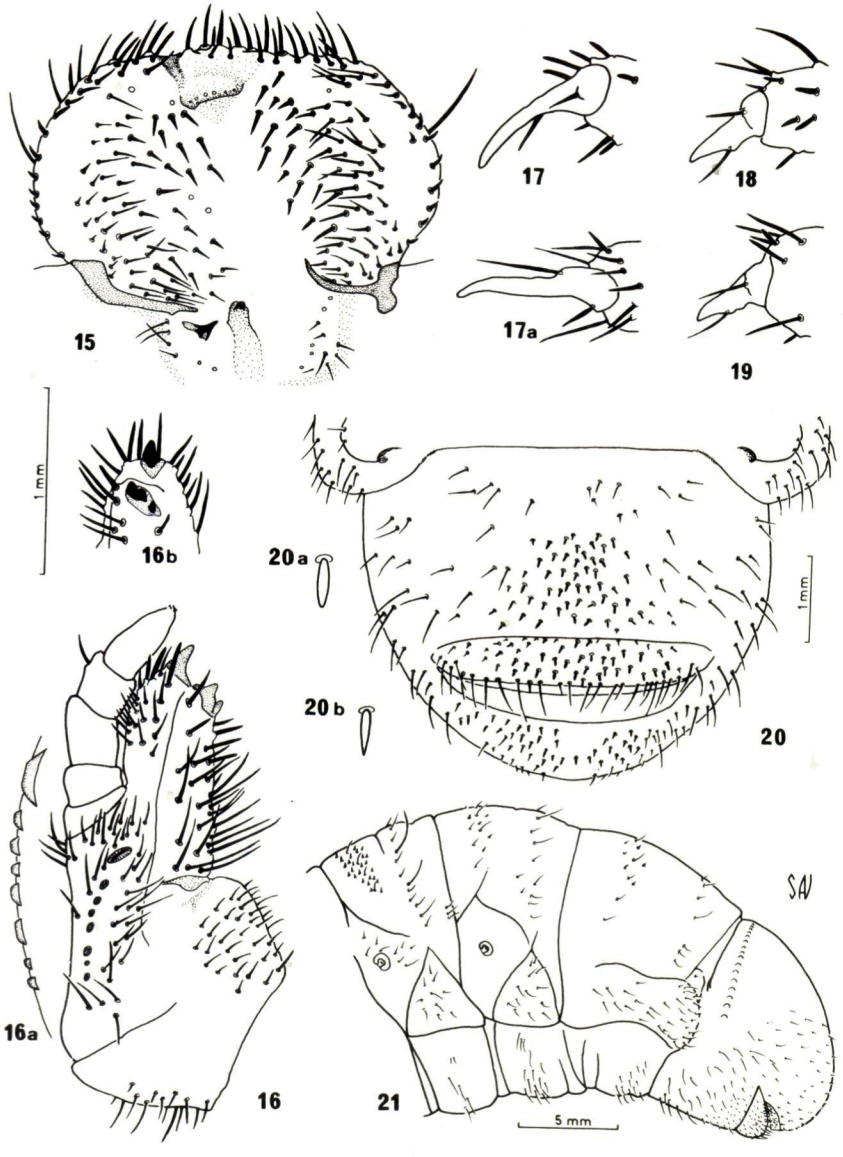
1. Scissorial area of left mandible with 3 teeth.
2. Chaetoparia of epipharynx with few or no sensilla among the setae.
3. Dorsa of abdominal segments 7, 8 and 9 each with numerous short, stout setae, and 2 widely separate transverse row of long setae.
4. Raster without palidia.
5. Each claw with 2 setae.

ACKNOWLEDGMENTS

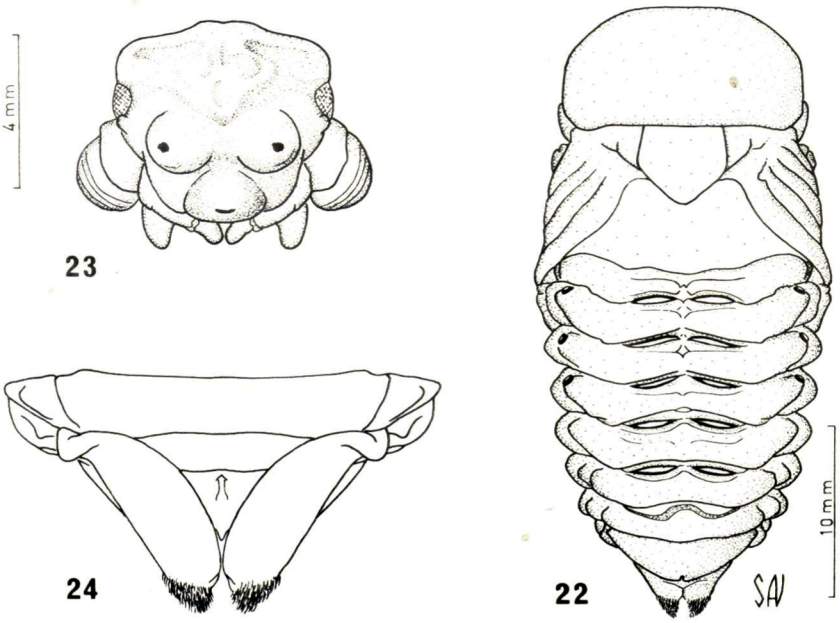
We thank Brett C. Ratcliffe (The University of Nebraska, Lincoln) for his useful comments on the manuscript and informations on some nomenclatural changes in the Dynastinae and Giro Pastore for the photographs.



Homophileurus luederwaldti. Fig. 1, head; fig. 2, labium, ventral view; fig. 3, labium, lateral view; figs. 4-9, mandibles: 4 and 9, dorsal view; 6 and 7, ventral view; 5 and 8, mesal view; figs. 10-12, last antennal segment, dorsal view, showing sensory spots; fig. 13, thoracic spiracle; fig. 14, structure of respiratory plate of thoracic spiracle (highly magnified).



Homophileurus luederwaldti. Fig. 15, epipharynx; fig. 16, left maxilla, dorsal view; fig. 16a, maxillary stridulatory teeth; fig. 16b, distal part of galea and lacinia showing unci; fig. 17, claw of prothoracic leg, lateral view; fig. 17a, dorsal view; fig. 18, claw of mesothoracic leg, lateral view; fig. 19, claw of metathoracic leg, lateral view; fig. 20, raster; figs. 20a and 20b, details of setae of teges; fig. 21, lateral view of seventh to tenth abdominal segments.

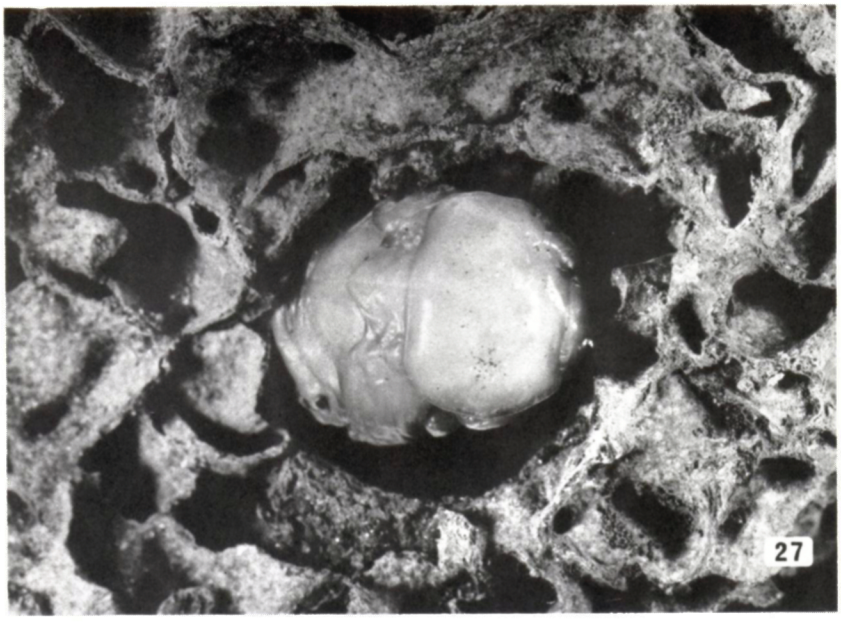


Homophileurus luederwaldti. Fig. 22, pupa, dorsal view; fig. 23, head, frontal view; fig. 24, apex of abdomen, ventral view.





Fig. 25, arboreal nest of the termite *Microcerotermes* sp.; Itanhaém, SP, "restinga" vegetation; fig. 26, broken nest showing the central hollow originated by beetle feeding. (Photos by L. R. Fontes).



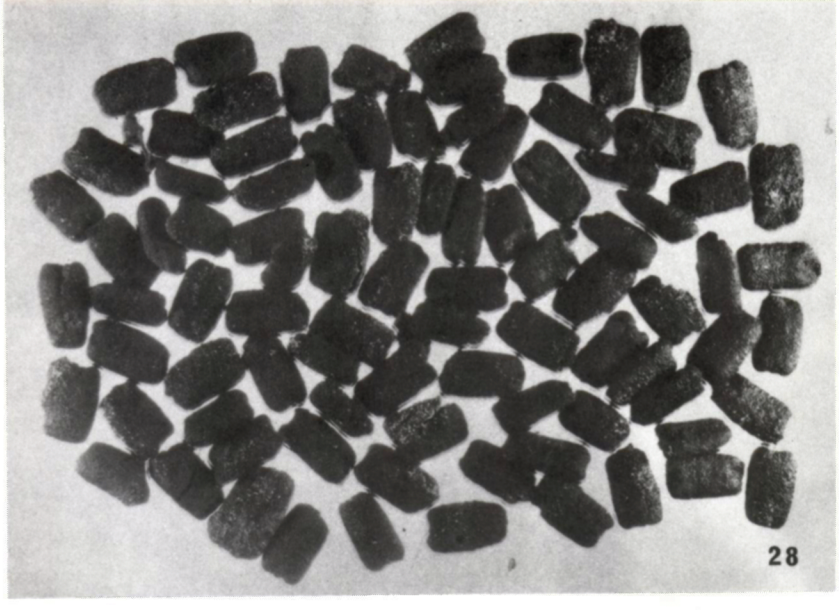
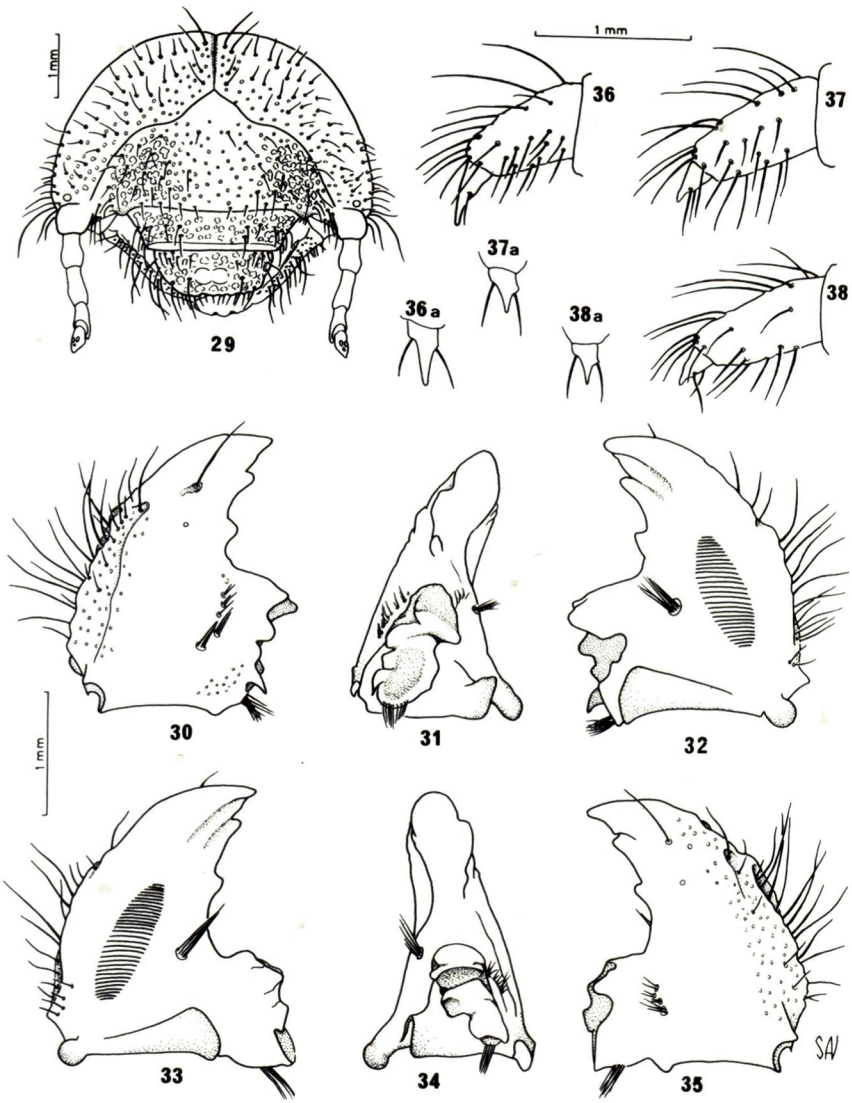
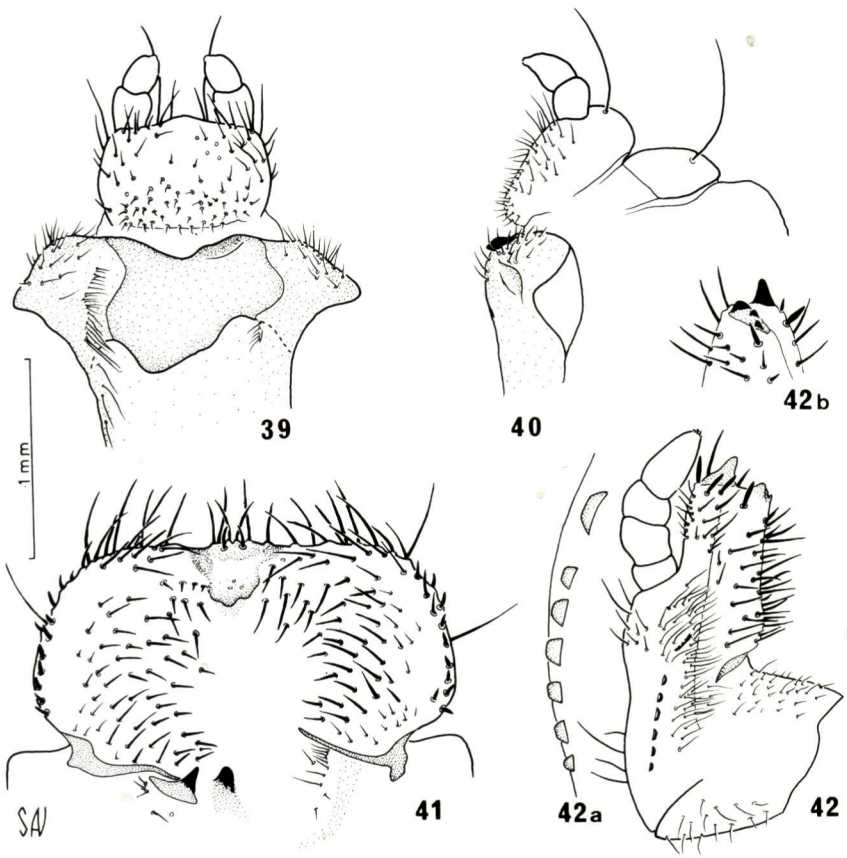


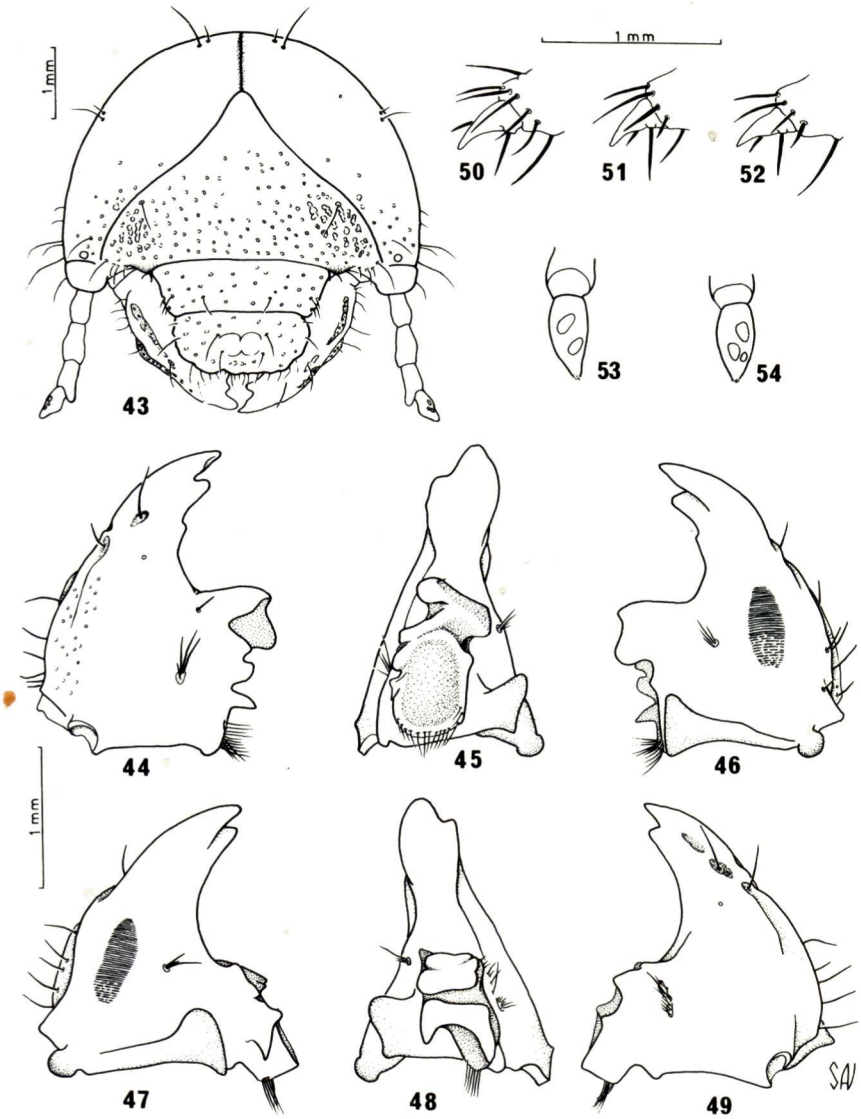
Fig. 27, pupa *Homophileurus luederwaldti* on pupal chamber dug in the walls of termite nest; fig. 28, fecal pellets of the third instar larvae of *H. luederwaldti*. (Photos by Giro Pastore).



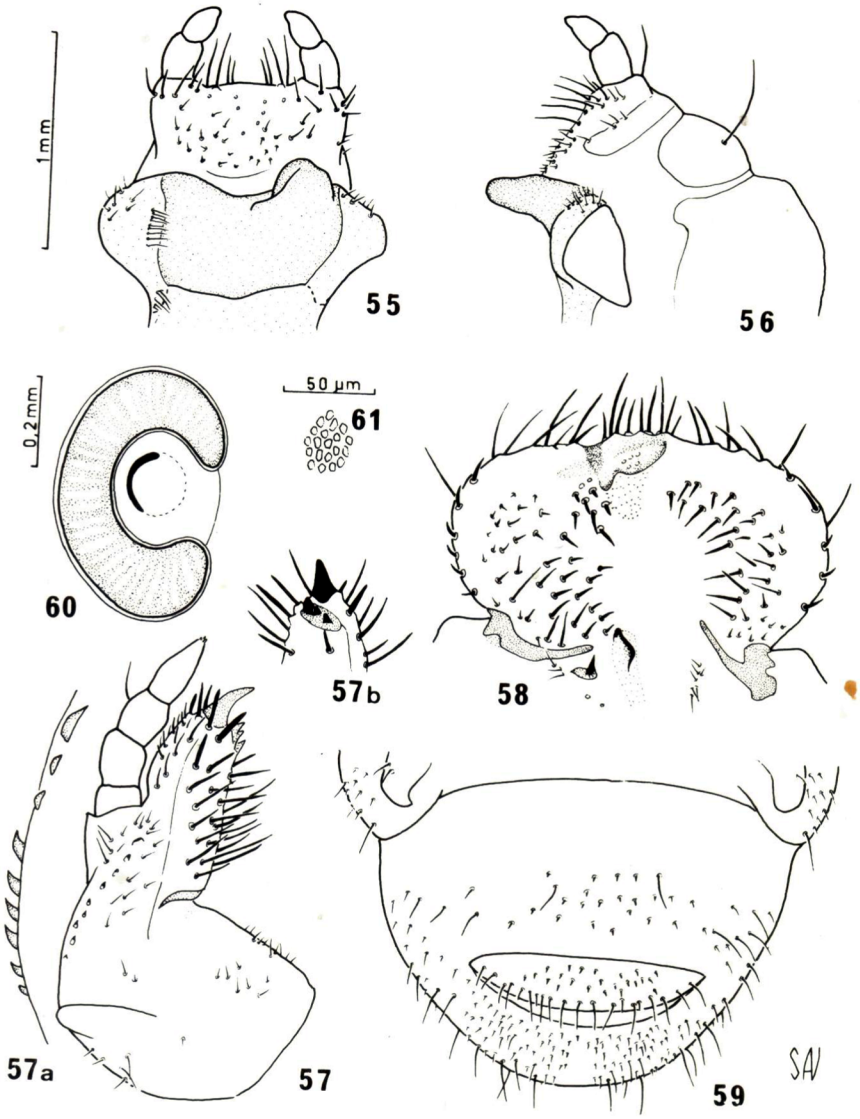
Actinobolus trilobus. Fig. 29, head; figs. 30-35, mandibles: 30 and 35, dorsal view; 32 and 33, ventral view; 31 and 34, mesal view; fig. 36, tibiotarsus and claw of prothoracic leg, lateral view; fig. 36a, prothoracic claw, dorsal view; fig. 37, tibiotarsus and claw of mesothoracic leg, lateral view; fig. 37a, mesothoracic claw, dorsal view; fig. 38, tibiotorsus and claw of metathoracic leg, lateral view; fig. 38a, metathoracic claw, dorsal view.



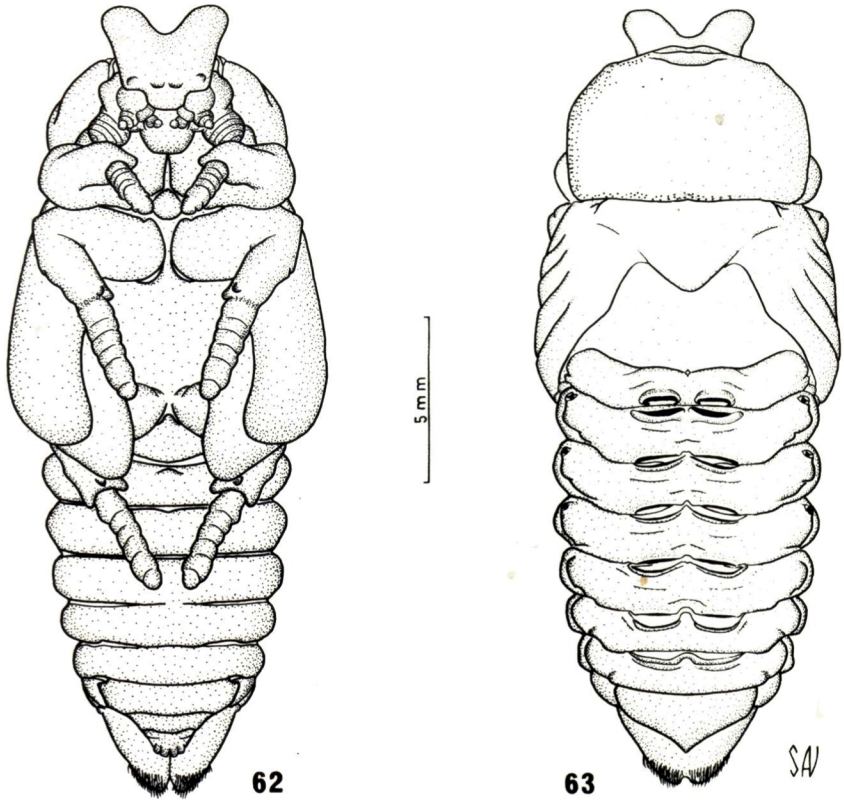
Actinobolus trilobus. Fig. 39, labium, ventral view; fig. 40, labium, lateral view; fig. 41, epipharynx; fig. 42, left maxilla, dorsal view; fig. 42a, maxillary stridulatory teeth; fig. 42b, distal part of galea and lacinia showing unci.



Trioplus cylindricus. Fig. 43, head; figs. 44-49, mandibles: 44 and 49, dorsal view; 46 and 47, ventral view; 45 and 48, mesal view; figs. 50-52, pro-, meso- and metathoracic claws respectively, lateral view; figs. 53 and 54, last antennal segment, dorsal view, showing sensory spots.



Trioplus cylindricus. Fig. 55, labium, ventral view; fig. 56, labium, lateral view; fig. 57, left maxilla, dorsal view; fig. 57a, maxillary stridulatory teeth; fig. 57b, distal part of galea and lacinia showing unci; fig. 58, epipharynx; fig. 59, raster; fig. 60, thoracic spiracle; fig. 61, structure of respiratory plate of thoracic spiracle (highly magnified).



Trioplus cylindricus, pupa. Fig. 62, ventral view; fig. 63, dorsal view.

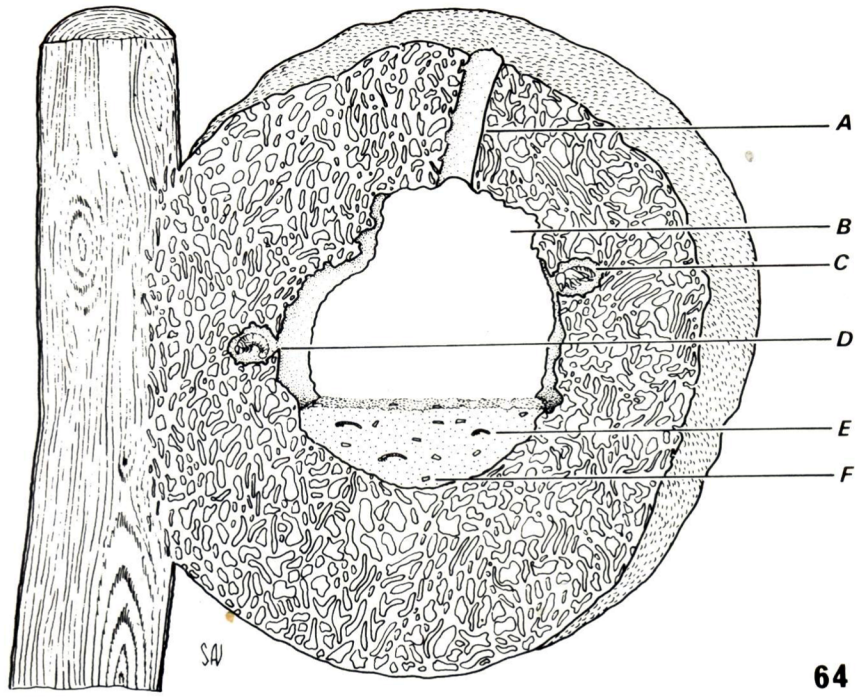


Fig. 64. Cross section of a nest of *Microcerotermes* sp. A- canal; B- central hollow; C-pupal chamber with scarab pupa; D-scarab larva feeding on nest walls; E- alleculid larva; F- scarab fecal pellets.

REFERENCES

Endrodi, S., 1977. Monographie der Dynastinae, 8. Tribus: Phileurini, Amerikanische Arten I. Fol. Ent. Hungarica 30 (1): 7-45.

Endrodi, S., 1978. Monographie der Dynastinae, 8. Tribus: Phileurini, Amerikanische Arten II. Fol. Ent. Hungarica 31 (2): 85-164.

Luederwaldt, H., 1910. *Actinobolus trilobus* n. sp. (Col. Dynastin.). Deutsche ent. Zeitschr. 1910: 95-96.

Luederwaldt, H., 1911. Quatro lamellicorneos termitophilos. Rev. Mus. Paulista 8: 405-413.

Ohaus, F., 1900. Bericht über eine entomologische Reise nach Centralbrasilien. Stettiner ent. Zeitung 60:164-191, 193-274.

Ohaus, F., 1909. Bericht über eine entomologische studienreise in Südamerika. Stettiner ent. Zeitung 70: 3-139.

Ohaus, F., 1910. Neue Südamerikanische Dynastiden (Col.). Deutsche ent. Zeitschr. 1910: 671-690.

Ritcher, P. O., 1944. Dynastinae of North America with descriptions of the larvae and keys to genera and species (Coleoptera, Scarabaeidae). Ky. Agr. Expt. Sta. Bull. 467: 1-47, 90 figs.

Ritcher, P. O., 1966. White Grubs and Their Allies. 219 pp., 501 figs. Oregon State University Press.